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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/762,164

01/21/2004

Liang-Gi Yao

2002-0246/24061.477

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HAYNES AND BOONE, LLP
901 MAIN STREET, SUITE 3100
DALLAS, TX 75202

EXAMINER

CHAMBLISS, ALONZO

ART UNIT

PAPER NUMBER

2814

MAIL DATE

DELIVERY MODE

09/13/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/762,164	YAO ET AL.	
	Examiner	Art Unit	
	Alonzo Chambliss	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 28-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 33-41 is/are allowed.
- 6) ☒ Claim(s) 28-32 and 42-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 1/21/04 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 28-41 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 28-32 and 46-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,350,993) in view of Lochtefeld et al. (US 2006/0197126).

With respect to Claim 28, 29, 31, 32, 46, Chu discloses a structure having a strained substrate 11-18 formed thereover, the strained substrate comprising an upper strained Si epi layer 15 having a thickness of 10nm = 100 angstroms, a middle relaxed Si_{1-x}Ge_x layer 12C having a thickness of .5micrometers = 5000 angstroms, and a lowermost graded Si_{1-y}Ge_y 12B having a thickness of .5micrometers = 5000 angstroms. At least one dielectric gate oxide 120 (i.e. SiO₂) portion over the strained substrate 11-18, wherein at least one dielectric gate oxide portion having a dielectric constant. A device (i.e. gate) over each of the at least one dielectric gate oxide 120 portion (see col. 5 lines 17-45, col. 6 lines 1-67, and col. 7 lines 1-50; Figs 1 and 9-12). Chu fails to disclose a dielectric gate oxide with a dielectric constant of greater than about 4.0 in a high-k device. However, Lochtefeld discloses a dielectric gate oxide (i.e. HfSiO₄) which inherently has a dielectric constant of greater than about 4.0 based on the composition of the material is in a high-k device. A lower silicon oxide 52 having a thickness of 1500 angstroms under a SiGe layer 18 with a thickness of 1000 angstroms. (see paragraphs 62, 64, 84, and 104; Fig. 8A). Thus, Chu and Lochtefeld have substantially the same environment of gate over a gated oxide layer and strained semiconductor material. Therefore, one skilled in the art at the time of the invention would readily recognize substituting the HfSiO₄ for the SiO₂ of Chu, since the HfSiO₄ material would provide a reliable dielectric material between the gate and substrate as taught by Lochtefeld.

With respect to Claim 30, Chu discloses where x is .65 and where y is .40 (see co. 6 lines 5-50). Chu discloses the claimed invention except for x is greater than 0 and

less than about .50 and where y is 0 or about 0 proximate structure and increases to about x proximate the middle relaxed $\text{Si}_{1-x}\text{Ge}_x$ layer, wherein x is greater than or equal to y . It would have been obvious to one having ordinary skill in the art at the time the invention was made to have x is greater than or equal to y , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

With respect to Claims 47 and 48, it is note that the specification contains no disclosure of either the critical nature of the Si epi layer having a thickness of 200 angstrom or any unexpected results arising therefrom. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate Si epi having a thickness of 200 angstroms into the product of strained Si epi having a thickness of 200 angstroms, since it has been held that where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16USPQ2d 1934, 1936 (Fed. Cir. 1990).

4. Claims 42-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,350,993) and Lochtefeld et al. (US 2006/0197126) as applied to claim 28 above, and further in view of Dwilinski et al. (US 2006/0057749).

With respect to Claim 42, Chu and Lochtefeld discloses the claimed invention except for a dislocation density of strained Si epi of less than about $1\text{E}6/\text{cm}^2$. However, it is well known in the semiconductor industry to have a dislocation density of strained Si epi of less than about $1\text{E}6/\text{cm}^2$ as evident by Dwilinski (see paragraph 2). Therefore,

one skilled in the art at the time of invention would readily recognize the strained Si epi of Chu-Lochtefeld having a dislocation density of less than about $1\text{E}6/\text{cm}^2$, since the Si epi layer of the substrate can support electronic devices when attached to the substrate as taught by Dwilinski.

With respect to Claims 43 and 44, Lochtefeld discloses a dielectric gate oxide comprising a HfSiO_4 with a silicon substrate 18, 52, and 54 (see paragraphs 78, 84, and 104).

5. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 6,350,993) and Lochtefeld et al. (US 2006/0197126) as applied to claim 28 above, and further in view of Currie et al. (US 7,217,603).

With respect to Claim 45, Chu and Lochtefeld discloses the claimed invention except for a strained substrate comprising only the uppermost strained Si epi layer. However, Currie discloses a strained substrate comprising only the uppermost strained Si epi layer (see col. 4 lines 20-40). Therefore, one skilled in the art would readily recognize incorporating only the uppermost strained Si epi layer as part of the substrate of Chu-Lochtefeld, since the strained Si epi layer would be a reliable material between the gate and the lower portion of the substrate as taught by Currie.

Allowable Subject Matter

6. Claims 33-41 are allowed.

7. The following is a statement of reason for the indication of allowance subject matter: the prior art of record does not teach or suggest the combination $\text{Si}_{1-y}\text{Ge}_y$ layer

over an epi layer over a lowermost relaxed Si_{1-z}Ge_z layer, wherein z is greater than or equal to y is greater than or equal to z along with the other limitations of claims 33 and 41.

The prior art made of record and not relied upon is cited primarily to show the product of the instant invention.

Conclusion

8. Any inquiry concerning the communication or earlier communications from the examiner should be directed to Alonzo Chambliss whose telephone number is (571) 272-1927.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the group receptionist whose telephone number is (703) 308-7956.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system see <http://pair-dkect.uspto.gov>. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free) or EBC_Support@uspto.gov.

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AC/September 12, 2007

/Alonzo Chambliss/
Primary Examiner, Art Unit 2814